

Abdominal T2-weighted Turbo-Spin-EchoImaging with BLADE at 3.0T: Initial Results

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Background

T2-weighted (T2w) sequences are pivotal for abdomino-pelvic MR-exams ^{1,2}. Currently, turbo-spin echo (TSE) sequences with Cartesian k-space sampling are considered as the gold standard. Periodically Rotated Overlapping ParalleEL Lines with Enhancement Reconstruction (PROPELLER) ³ is a different and promising technique for k—space data acquisition. No study has yet addressed the value of PROPELLER-techniques for morphologic abdomino-pelvic T2w-TSE imaging at 3.0T. Therefore, we sought to evaluate the feasibility and image quality of T2w-TSE sequences with Cartesian k-space sampling and with PROPELLER intraindividually in healthy volunteers and in patients at 3.0T.

Materials and Methods

After IRB approval 7 healthy volunteers (3 female, 4 male, mean age 29.9 years) and 17 patients (7 female, 10 male, mean age 58.2 years) were included in this prospective study. The patients were referred for abdomino-pelvic MR-exams of the (transplant) kidneys. All volunteers and patients were examined at 3.0T (Siemens Tim Trio, Siemens Medical Solutions) in a random order with a standard T2w-TurboSpinEcho (TSE) sequence (TR / TE – 2000 / 81ms; FOV / matrix – 400x400mm² / 320x320; BW 260 Hz/px; ETL – 11) and with a T2w-BLADE sequence (TR / TE – 4670 / 113ms; FOV / matrix – 400x400mm² / 320x320; BW 363 Hz/px; ETL – 35). BLADE is the Siemens implementation of the PROPELLER technique ⁴. The spatial resolution was kept equal at 1.3x1.3x4.0mm³ for both techniques. Both sequences used parallel imaging (GRAPPA) with an acceleration factor of 2 and prospective respiratory gating (PACE). The total scan time was 2:54 min for the T2w-TSE with Cartesian k-space sampling and 2:11 min with the T2w-BLADE. In order to obtain objective measurements of the signal-to-noise ratio (SNR) despite the application of parallel imaging techniques phantom measurements were performed with a cylindrical water phantom. The phantom was measured 20 times in an identical position with both sequences and the SNR was calculated pixel-wise. Two radiologists rated the image sharpness, the flow voids, the presence of artifacts and the overall image quality of both techniques. They then determined their preferred sequence. T-tests (SNR), Wilcoxon rank-sum tests and a Kappa-interreader correlation tests were performed for statistical analysis.

Results

The SNR did not show significant differences (**Figure 1**). The overall image quality was rated higher for the T2w-BLADE by both readers (p=n.s and p=0.01). Equally, the presence of disturbing artifacts and the sharpness was ranked significantly (p=0.04) better for T2w-BLADE than for the T2w-TSE. The T2w-BLADE was the preferred sequence in 64.5% of all cases, no sequence was preferred in 22.9%. The interreader agreement for the determination of the preferred technique was 0.69.

Conclusions

Using BLADE for abdominal T2w-imaging at 3.0T is feasible. The image quality of T2w-BLADE sequences seems to be superior to T2w-TSE sequences with Cartesian k-space sampling particularly due to the decreased number of artifacts and sharper delineation of the abdominal organs.

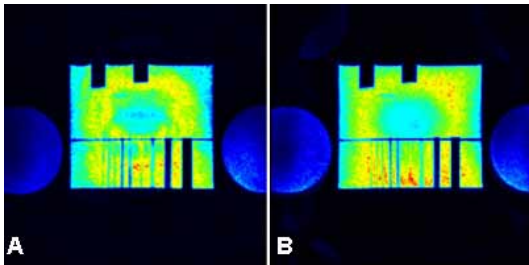


Figure 1

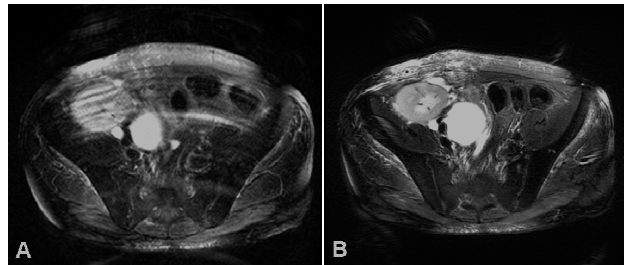


Figure 2

Figure 1: Exemplary color-coded parameter maps of the SNR measured with T2-TSE (ETL-11) (A) and with T2w-BLADE (B). Subjectively, there seems to be no difference between the distributions of the SNR. However, already in this phantom study the typical peripheral artifacts caused by the rotating phase-encode direction can be clearly seen (B).

Figure 2: Axial T2w-images (A-T2w-TSE (ETL-11) – B-T2w-BLADE) of a 51 year-old male patient who presented with renal transplant dysfunction. Using the standard T2w-TSE technique (A) severe pulsation artifacts can be appreciated. The kidney can be hardly marked off because of the artifacts. Using the T2w-BLADE sequence (B) the image reveals only slight reconstruction artifacts in the periphery which do not interfere with the diagnostic information. The kidney is clearly lined out; also the lymphocele medial to the kidney can be clearly depicted.

References

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